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The cognitive representation of time and duration

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Abstract

How do people represent the duration of an event in memory and which mechanisms except timing are involved in processing and maintaining temporal information within the cognitive system? The speakers of this symposium will address this and related questions. Anne-Claire Rattat focuses on long-term retention of durations in children and adults. Ruth Ogden discusses executive functions that are involved in timing and time perception. Hedderik van Rijn and Niels Taagten show how general principles of memory and attention can be connected with theories about time perception. Finally, Daniel Bratzke reviews prominent ideas about how temporal information is coded within and across sensory modalities. The titles and abstracts of the four talks are given below.

Keywords: Long-term retention of durations; executive functions of timing; reasoning skills; encoding of temporal information

1. Maintenance of duration representation in memory in children and adults *by Anne-Claire Rattat*

Estimating the duration of an event often requires that we reference our own knowledge about the duration of similar events stored in long-term memory. Therefore, the ability to encode and maintain events' durations in long-term memory is a keystone of time estimation. Even so, we know relatively little about the retention of temporal information in long-term memory. Moreover, the few studies examining this issue have mainly focused on the

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encoding of durations in memory and its consequences on time discrimination, and rarely on the effect of the long-term retention of durations, once they have been learned and stored in reference memory. The purpose of this talk is to present studies investigating this issue, both in adults and in young children, and to discuss the findings in the framework of a discrepancy in the memory retention of duration as a function of the nature of the memory system, i.e., implicit or explicit. Indeed, in a first series of studies (e.g., Rattat & Droit-Volet, 2010), we focused on the long-term retention of new arbitrary stimulus durations, and used memory tasks that are associated with subjective awareness of engaging in recall, thus examining the retention capacity in the case of explicit long-term memory. In contrast, in other studies (e.g., Rattat & Droit-Volet, 2007), we investigated participants' ability to maintain in long-term memory a duration of an action they have previously experienced (i.e., implicit long-term memory for duration).

2. How and why are executive resources recruited during timing? ***by Ruth Ogden***

Cognitive models of human temporal perception, such as Scalar Expectancy Theory, suggest that timing is dependent on more than just an internal clock. Attention, short-term memory and long-term memory are all thought be to be recruited during the timing process. Exploration of the precise way in which these wider cognitive resources are involved in timing is required to advance models of temporal perception. Recent research has focused on the role of executive functions in timing. There is growing evidence from dual-task studies which suggests that executive resources are recruited during timing (Brown, 2006; Ogden et al., 2011). However, there has been little exploration of whether executive recruitment is universal across temporal tasks or, whether different temporal tasks recruit different executive resources. This talk will review existing evidence for the role of executive functions in timing and discuss how this recruitment may vary on different temporal tasks. Evidence from recent individual differences studies of timing and executive function will be used to highlight the differential involvement of access, switching, inhibition and updating resources in different timing tasks. Implications for cognitive models of time, task selection and clinical studies of timing will be discussed.

3. Time perception: the big picture ***by Hedderik van Rijn & Niels Taatgen***

The challenge of understanding time perception is that it is more often an implicit part of daily life instead of an explicit task. The big questions about time perception may therefore be more than explaining the scalar property, but rather how time perception interacts with other aspects of cognition, like attention and memory (Van Rijn et al, 2011), and even more importantly, how time is integrated in reasoning skills that each individual develops on their own (Taatgen, van Rijn & Anderson, 2007). In my talk I will show how general principles of memory and attention can connect myopic theories about time perception to a larger framework, and will preview how the development of general reasoning skills can also include an element of time (Taatgen, 2013).

4. The encoding of temporal information from different sensory modalities ***by Daniel Bratzke***

Presently there exist three prominent hypotheses as to how temporal information is encoded: amodal, crossmodal, and modality-specific encoding. According to the amodal (e.g., Ulrich, Nitschke, & Rammsayer, 2006) and the crossmodal encoding hypotheses (e.g., Guttman, Gilroy, & Blake, 2005) the same code is shared for temporal information from different sensory modalities. In contrast, the modality-specific encoding hypothesis assumes that temporal information is encoded in a modality-specific way (e.g., Rattat & Picard, 2012). In this talk I will evaluate the validity and the limits of these hypotheses in light of current studies using such diverse experimental accounts as dual-task, distractor and perceptual learning paradigms.

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